

CLAIMS:

1. A parametric encoder for encoding an audio or speech signal s into sinusoidal code data, comprising:

- a segmentation unit (120) for segmenting said signal s into at least one single scale segment $x_m(n)$ with $m = 1 \dots M$ and for outputting the samples $x_m(0), \dots, x_m(L-1)$ of said segment $x_m(n)$; and

- a sinusoidal estimation unit (140) for estimating the sinusoidal code data representing said segment $x_m(n)$ from the received samples $x_m(0), \dots, x_m(L-1)$); characterized in that

- the segmentation unit (120) is further embodied for carrying out a frequency-warping operation in order to transform the output samples $x_m(0), \dots, x_m(L-1)$ onto a frequency-warped domain; and

- a post-processing filter (160) is provided for re-mapping said sinusoidal data output from the sinusoidal estimation unit (140) to the original frequency domain of the signal s .

2. The parametric encoder according to claim 1, characterized in that the segmentation unit (120) comprises

- a plurality of $L-1$ filters (122_1, ... 122_L-1) being connected in series for receiving the signal $s(n)$ at the input of the first of said filters (122_1); and

- a sampling unit (124) for receiving and sampling said signal $s(n)=y_0(n)$ as well as the output signals

- $y_1(n) \dots y_{L-1}(n)$ of said $L-1$ filters (122_1, ... 122_L-1) in order to generate L samples $x_m(0), \dots, x_m(L-1)$ or $x_m^0(0), \dots, x_m^0(L-1)$ of the segment x_m .

3. The parametric encoder according to claim 2, characterized in that at least some of the filters (122_1, ... 122_L-1) are embodied as all-pass filters.

4. The parametric encoder according to claim 3, characterized in that the some filters (122_1, ... 122_L-1) are embodied as first-order all-pass filters each having a transfer function $A(z)$ according to:

$$A(z) = \frac{-\lambda^* + z^{-1}}{1 - \lambda z^{-1}},$$

wherein λ^* denotes a complex-conjugation and wherein λ is preferably real valued.

5. The parametric encoder according to claim 4, characterized in that all of the filters (122_1, ... 122_L-1) out of the plurality of filters are embodied as first-order all-pass filter, each having a transfer function $A(z)$ according to:

$$A(z) = \frac{-\lambda^* + z^{-1}}{1 - \lambda z^{-1}},$$

wherein λ^* denotes a complex-conjugation and wherein λ is preferably real valued.

6. The parametric encoder according to claim 4, characterized in that the first filter (122_1) in said series connection receiving the signal $s(n)$ has a transfer function $A_0(z)$ according to:

$$A_0(z) = \frac{1}{1 - \lambda z^{-1}},$$

the second filter (122_2) in said series connection following said first filter (122_1) has a transfer function $A_1(z)$ according to:

$$A_1(z) = \sqrt{1 - |\lambda|^2} \frac{z^{-1}}{1 - \lambda z^{-1}}, \text{ and}$$

the remaining filters (122_3...122_L-1) each are first order all-pass filters having a transfer function $A(z)$ according to claim 4.

7. The parametric encoder according to claim 2, characterized in that

- in the segmentation unit (120) the plurality of L-1 filters (122_1, ... 122_L-1) being connected in series is embodied as tapped delay-line with each of the filters having a transfer function of $A(z) = z^{-1}$; and

- there is additionally provided a bi-lateral warping unit (126) for transforming the samples on the original frequency-domain of the signal s $x_m^o(-N_1), \dots, x_m^o(N_2)$ output by the sampling unit (124) into transformed samples $x_m(-M_1), \dots, x_m(M_2)$ on a frequency-warped domain by applying a bi-lateral frequency-warping operation to the samples $x_m^o(-N_1), \dots, x_m^o(N_2)$ and for outputting the transformed samples $x_m(-M_1), \dots, x_m(M_2)$ to said sinusoidal estimation unit (140).

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8. The parametric encoder according to claim 7, characterized in that the bi-lateral warping unit (126) carries out the transformation of the samples x_m^o into the samples x_m according to:

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$$\begin{pmatrix} \vdots \\ x_m(-n) \\ \vdots \\ x_m(-1) \\ x(0) \\ x(1) \\ \vdots \\ x_m(n) \\ \vdots \end{pmatrix} = \begin{pmatrix} \vdots & \vdots \\ q(n, N_1) & \dots & q(n, 1) \\ \vdots & \vdots \\ q(1, N_1) & \dots & q(1, 1) \\ q(0, N_1) & \dots & q(0, 1) \\ & q(0, 1) & \dots & q(0, N_2) \\ & q(1, 1) & \dots & q(1, N_2) \\ & \vdots & \vdots \\ & q(n, 1) & \dots & q(n, N_2) \\ & \vdots & \vdots \end{pmatrix} \begin{pmatrix} x_m^0(-N_1) \\ \vdots \\ x_m^0(-1) \\ x_m^0(0) \\ x_m^0(1) \\ \vdots \\ x_m^0(N_2) \end{pmatrix}$$

wherein q columnwise represents the impulse responses of the tapped line of all-pass filters (122_1 ... 122_L-1).

20 9. Method for encoding an audio or speech signal s into sinusoidal code data, comprising the steps of:

- segmenting said signal s into at least one single scale segment $x_m(n)$ with $m=1 \dots M$ having the samples $x_m(0), \dots, x_m(L-1)$; and

- estimating the sinusoidal code data representing said segment $x_m(n)$ from the received samples $x_m(0), \dots, x_m(L-1)$;

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- a frequency-warping operation is carried out such that the samples $x_m(0)$, ..., $x_m(L-1)$ are provided on a frequency-warped domain; and
- said sinusoidal data being estimated on the frequency-warped domain are re-mapped to the original frequency domain of the signal s .